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ABSTRACT

A study evaluated the potential of low-cost microcomputers for enhancing the effectiveness of adult basic education (ABE) programs conducted for mentally handicapped adults. In conducting the study, researchers selected a sample of 36 mentally-handicapped adults who were served by the San Antonio State Hospital and the San Antonio State School. These adults were divided into three groups, each of which underwent basic literacy skill (reading comprehension) instruction using either a low-cost microcomputer, the programed instructional format, or traditional classroom methods. During the study, two learning conditions were assessed--massed versus spaced learning. Analysis of the results obtained revealed that computer-assisted instruction was superior as an instructional methodology to both programed instruction and traditional classroom teaching approaches. The results also suggested that spaced practice was clearly superior to massed practice in terms of facilitating learning. A final phase of the project involved the development of a manual to provide adult education teachers with the knowledge necessary to implement a similar microcomputer instructional program. (MN)

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Final Report

FOR A SPECIAL PROJECT IN ADULT EDUCATION

Entitled

A PILOT PROJECT TO EVALUATE THE USE OF LOW-COST MICROCOMPUTERS TO IMPROVE THE EFFECTIVENESS OF ABE SERVICES PROVIDED MENTALLY HANDICAPPED ADULTS

Conducted for the

DIVISION OF ADULT AND COMMUNITY EDUCATION PROGRAMS

TEXAS EDUCATION AGENCY

AUSTIN, TEXAS

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PROJECT ABSTRACT

The Special Project in Adult Education outlined in the accompanying report centered on evaluation of the potential that low-cost microcomputers possess for enhancing the effectiveness of adult basic education programs conducted for mentally handicapped adults. While much has been written concerning the advantages for education of elaborate computer assisted instruction programs such as PLATO, the fact remained that the limited budgets available to adult basic education programs ruled out any broad scale effort to bring such high technology to the typical adult basic education classroom. It seemed to the project staff, that advances in microelectronics technology might conceivably be harnessed to provide a cost-effective way to help automate the adult basic education teaching process for special populations, such as mentally handicapped adults who lacked basic literacy skills. These advances concerned primarily the availability of low-cost microcomputers literally "off-the-shelf" - at a cost not a great deal more than that for a good quality slide projector. Such microcomputers had come to possess the power and versatility of large computers which, until recently, cost in the range of hundreds of thousands of dollars. The special project being reported on undertook carefully to examine the extent to which these inexpensive devices could be harnessed to help improve the adult basic education process for mentally handicapped individuals. The idea was to have the microcomputers assume the lion's share of routine teaching tasks and records management - so that the teacher would be able to give more individual attention to the students in need, thus helping motivate them to succeed. Attainment of the following major objectives guided conduct of the project:

Objective I: Assess the potential of low-cost microprocessors for improving adult basic education procedures used with mentally-handicapped adults by comparing the effectiveness of learning of students taught basic literacy skills (reading comprehension) materials (1) via traditional teacher-centered methods and (2) via the use of low-cost microprocessors.

Objective 2: In an extension of Objective 1, assess the potential of low-cost microprocessors for improving adult basic education procedures used with mentally-handicapped adults by comparing the effectiveness of learning for students taught basic literacy skills (reading comprehension) (1) via programmed instruction (programmed text) methods and (2) via the use of low-cost microprocessors.

Objective 3: Mindful of the potential interactive effect upon learning of the conditions surrounding the learning experience of mentally-handicapped individuals (who many times have problems associated with short attention span and distractibility), assess the efficacy of the teaching approaches specified in Objectives 1 and 2 under (1) massed and (2) spaced conditions. For this purpose, massed learning was defined as a full 60 minutes of continuous presentation of subject material followed by a 10 minute break, then a second 60 minute learning period, for the day's total instructional unit. Spaced learning was defined as consisting of 30 minute periods of continuous presentation of subject material followed by a 10 minute break from learning, this cycle then being completed until 120 minutes of subject matter had been presented for the day's total instructional unit.

Analysis of results obtained with thirty-six mentally-handicapped adult participants revealed that, within the institutionalized population studied, computer assisted instruction - as an instructional methodology was superior to both the programmed instruction and traditional classroom teaching approaches. The results also suggested that - for the particular population studied - spaced practice was clearly superior to massed practice in terms of facilitating learning.

INTRODUCTION

Concern among the mental health and mental retardation professions for improved achievement in the basic skills for institutionalized mentally-handicapped individuals has been mounting in recent years. This is because, being illiterate, these individuals cannot be trained readily to enter the nation's work force and attain a reasonable level of self-sufficiency following their release from treatment and return to the community. The result is that many mentally-handicapped individuals remained institutionalized when - if afforded appropriate remediation of their educational deficits - they might be restored to a productive role in society. It is becoming increasingly obvious that adult basic literacy programs must attempt to overcome the many debilitating factors in this particular population and at the same time attend to very broad differences in chronological age, life experiences, and physical and mental health present in this special population. Obviously, an instructional progress capable of responding to differences as great as these must use individualized instructional techniques which are capable of enhancing motivation for learning, reinforcing increased student achievement and developing an improved model of management for the adult mentally-handicapped student learning process.

No where is the gravity of the situation just described recognized more than at the San Antonio State Hospital and State School. This is a public residential facility operated by the Texas Department of Mental Health and Mental Retardation. It is charged with the responsibility of providing a full range of comprehensive therapeutic and educational services to mentally impaired (psychiatric and mentally retarded) clients. At the present time, services are being provided to over 800 psychiatric patients and over 400 mentally retarded clients. Most of these individuals are functionally illiterate and require intensive educational intervention to help them overcome their educational deficits. The one adult basic education teacher made available through the ABE Co-operative supporting the facility, cannot even remotely meet the legitimate educational needs of the clients residing in the institution. The need for alternative procedures was clearly evidenced. This led the facility to request support from the Texas Education Agency (under an adult education special project) to investigate

the feasibility of alternative approaches. Such support was awarded, in the form of a one year duration adult education special project, which became effective July 1, 1981:

Specifically, the special project provided resources to permit the facility to conduct a pilot project designed to evaluate the potential that low-cost microcomputers have for enhancing the effectiveness of adult basic education programs conducted for mentally-handicapped adults. While much has been written concerning the advantages for education of elaborate computer assisted instruction programs such as PLATO, the fact remains that the limited budgets available to adult basic education programs, particularly those serving the handicapped, rule out any broad scale effort to bring such high-cost technology to the typical adult basic education classroom. Fortunately, recent advances in microelectronics technology held the promise of providing a cost-effective way to help automate the adult basic education teaching process for special populations, such as mentally-handicapped adults who lack basic literacy skills. These advances concern the availability of low-cost microcomputers. These microcomputers have the power and versatility of large computers which until recently, cost exceedingly large sums. The special project referenced proposed to carefully examine the extent to which these inexpensive devices could be harnessed to help improve the adult basic education process for mentally-handicapped individuals, by assuming a large share of routine teaching tasks and records management. This would enable the teacher to give more individual attention to the students in need, thus helping motivate them to succeed. Further, it would permit an increased number of students to be served because the microcomputer - not the teacher - would function as the individual "tutor". Unlike "normal" adults, the mentally-handicapped require almost a one-to-one interaction.

The crucial concept involved in this innovative approach was to harness the potential that the low-cost microcomputers had to effectively perform many of the routine, time-consuming tasks - such as drill, review, testing, remedial teaching, etc., that consumed so much of the teacher's time - limiting severely the number of students which could be served.

With the project support awarded, the facility undertook development of a microcomputer-based instructional approach to developing basic reading

skills for the mentally-handicapped adult which met the following criteria:

1. The system developed must use low-cost technology to perform most of the routine tasks performed by the teacher (drill, reviews, etc.) so that one teacher can serve a much larger number of students.

2. The system developed must be low in cost, and use "off-the-shelf" readily available components.

3. The system developed must be totally individualized and feature a highly adaptive and responsive teaching-learning approach.

4. The individual curricula developed for the system must be modularized and structured in coherent, hierarchical patterns.

5. The intended learning outcomes for the curricula used within the system must be expressed in terms of performance objectives with mastery criteria appropriately specified.

6. A mastery learning model must be employed, as a basis for student advancement to succeeding instructional content.

7. Diagnostic and prescriptive strategies must be incorporated in the system to the maximum possible extent, featuring abundant use of such instructional tools as tutorial lessons, drill-and-practice lessons, testing, and tutorial reviews.

SPECIFIC OBJECTIVES OF THE PROJECT

The following objectives were accomplished as a result of the effort described elsewhere in this final report:

Objective 1: The potential of low-cost microprocessors for improving adult basic education procedures used with mentally handicapped adults was examined by comparing the effectiveness of learning of students taught basic literacy skills (reading comprehension) materials (1) via traditional teacher-centered methods and (2) via the use of low-cost microprocessors. Reading comprehension skills were defined traditionally as embracing such key comprehension tasks as finding the main idea, locating basic facts, putting events in their proper order, and remembering details, etc.

Objective 2: In an extension of objective 1, the potential of low-cost microprocessors for improving adult basic education procedures used with mentally-handicapped adults was examined by comparing the effectiveness of learning for students taught basic literacy skills (reading comprehension) (1) via programmed instruction (programmed text) methods and (2) via the use of low-cost microprocessors.

Objective 3: Mindful of the potential interactive effect upon learning of the conditions surrounding the learning experience of mentally-handicapped individuals (who many times have problems associated with short attention span and distractibility), the efficacy of the teaching approaches specified in objectives 1 and 2 was assessed under (1) massed and (2) spaced conditions. For this purpose, massed learning was defined as a full 60 minutes of continuous presentation of subject material followed by a 10 minute break, then a second 60 minute learning period, for the day's total instructional unit. Spaced learning was defined as consisting of 30 minute periods of continuous presentation of subject material followed by a 10 minute break from learning, this cycle being completed until 120 minutes of subject matter had been presented for the day's total instructional unit.

Objective 4: The potential of low-cost microprocessors for managing routine, time-consuming functions necessarily performed as part of the teaching process were examined, to include automation of testing and scoring; automation of attendance record keeping functions; analysis of progress towards mastery of specific instructional objectives so that remedial instruction could be provided as needed.

The project staff also developed - and disseminated to all of the adult basic education co-ops in Texas - a comprehensive manual (1) outlining how low-cost microprocessor technology can be introduced effectively into the adult education process for mentally-handicapped adults and (2) containing guidelines for developing computer assisted instruction programs for a variety of basic literacy skills subject matter areas.

DESCRIPTION OF PROCEDURES USED IN THE PROJECT

In conducting the project, six (6) microcomputers obtained with funding provided by the resources of the San Antonio State Hospital and San Antonio State School were used to set up a special computer-assisted instruction laboratory, located adjacent to the adult basic education classroom where instruction is normally provided to those mentally-handicapped clients who require assistance in attaining proficiency in basic literacy skills. Then, from the mentally-handicapped population served by the San Antonio State Hospital and San Antonio State School, three groups of clients were selected to participate in the pilot project (N=36). These consisted of:

Group A - This group underwent basic literacy skill (reading comprehension) instruction presented via the low-cost microprocessor.

Group B - This group underwent basic literacy skills (reading comprehension) instruction presented via the programmed instruction format.

Group C - This group functioned as the control group, and was presented basic literacy skills (reading comprehension) training via traditional classroom methods.

Two learning conditions were assessed during the study: massed versus spaced learning. For this purpose, massed learning was defined as a full 60 minutes of continuous presentaiton of subject material followed by a 10 minute break, then a second 60 minute learning period, for the days total instruction unit. Spaced learning was defined as consisting of 20 minute periods of continuous presentation of subject matter, followed by a 10 minute break from learning, this cycle being repeated until 120 minutes of subject matter had been presented for the day's total instructional unit.

In the study, care was taken to equate the three groups as much as practical in terms of age, IQ, sex, diagnoses, present level of mastery of basic literacy skills (reading comprehension) and any other variable construed as possibly being correlated with the dependent variable studied. This permitted experimental control of these variables (which might have constituted possible causal influences) so that they would not confound the results obtained from statistical analysis of pilot study results. The analytic method used to assess results is described in the evaluation section of this final report.

Equivalent subject matter was prepared for use under each of the three learning conditions specified. For ease of control, the subject matter to be dealt with in the study was restricted to the reading comprehension skills area. A pre and post-test adequately sampling the universe of knowledge dealt with in the study was developed and administered to all participating individuals, to reveal their level of competence in reading comprehension. The test was based on an adaptation of the California Achievement test published by the California Test Bureau.

The project staff developed a comprehensive teacher's manual for distribution to all adult education co-ops, so that they might benefit from the experience gained from the pilot project. This manual addressed such areas as:

* Developing competence in programming the microcomputer with regard to teaching strategies and learning materials.

* Developing competence in using the microcomputer capability for proper data collection and summarization, to permit appropriate program modifications and optional day-to-day scheduling of learning materials.

* Developing competence in using the maximum potential of the microcomputer for other than conventional text mode (computer generated audio messages, computer generated graphics, and other displays) as a means of facilitating learning.

* Developing skill in effective use of the microcomputer's "comparator" function, which is quite important when dealing with mentally-handicapped adult learners who often may not have adequate discriminations at the beginning of a learning unit. With this particular special population it is often too difficult or distracting for the student to compare his or her own particular response with the standard or alternatives provided by the author. The microcomputer is capable not only of making this comparison but also can be programmed to give detailed feedback in regard to the discrepancy between response and standard.

* Developing skill in using the potential inherent in microcomputers for providing immediate feedback to the learner and for being responsive to his or her individual learning needs, as a means of improving learning. With today's technology, the teacher-programmer can adjust the instructional process to each mentally-handicapped student's needs and abilities - approximating the highly adaptable nature of conversational interaction as found in the master teacher-student tutorial process.

In essence, the manual developed sought to provide all essential knowledge that an adult education teacher would need to select microcomputer hardware items; "program" instructional material to be presented by it to the mentally-handicapped adult learner; evaluate the results attained, so as to assess the efficiency of the materials developed, and revise the program governing the student-microcomputer interaction to improve efficiency of the computerized instructional process.

Figure 1 The computer assisted instruction laboratory set up for operation of the adult education special project.

Figure 2 The "traditional" adult basic education classroom used for adult education special project.

Figure 3 Mentally-handicapped student using programmed text instructional materials developed for use in the adult education special project.

Figure 4 Mentally-handicapped student using one of the TRS-80 microcomputers and instructional courseware developed for the adult education special project.

Project Evaluation

As indicated earlier in this final report, the study involved three approaches to teaching adult basic education skills to mentally handicapped individuals: Method A - Computer Assisted Instruction; Method B - Programmed Instruction and Method C - Conventional Classroom Instruction. Since there was reason to expect that the duration of training session might also be an important consideration (due to the short attention span and distractibility characteristic of many mentally-handicapped individuals) a comparison of spaced versus massed learning conditions was also assessed. Under the spaced conditions, students received short periods of intensive instruction separated by an extended time interval. Under the massed learning condition, the students received instruction for a prolonged period of time. For this purpose, massed learning was defined as a full 60 minutes of continuous presentation of subject material, followed by a 10 minute break, then a second 60 minute learning period, for the day's total instructional unit. Spaced learning consisted of 20 minute periods of continuous presentation of subject material followed by a 10 minute break from learning, this cycle being repeated until 120 minutes of subject matter had been presented, for the day's total instructional unit. Thus, the evaluation addressed the effect on learning of six possible combinations of three teaching methods and two learning conditions. This constitutes a 3x2 factorial analysis involving three variables. Two of the variables (method and learning condition) are independent variables, with the other (test score) being the dependent variable. This insured that three variate values would be available for each participant - the instructional method used, the learning condition, and test scores.

Traditional analysis of variance procedure was used to analyze study results. The aim in this analysis was to explore the relation between the learning condition and the test scores and the teaching method and test scores.

Summary statistical data concerning the evaluation follows:

Notations Relevant to the Analysis of Teaching Method Used

A = Computer Assisted Instruction Material Presented In Spaced Format

B = Programmed Text Instructional Material Presented In Spaced Format

C = Traditional (classroom) Instruction Presented In Spaced Format

D = Computer Assisted Instruction Material Presented In Massed Format

E = Programmed Text Instructional Material Presented In Massed Format

F = Traditional (classroom) Instruction Presented In Massed Format

N=36

Two Way Anova
For
Reading Comprehension

SPACED

A = CAI
B = Programmed Text
C = Conventional Workbook
(Traditional)

MASSED

D = CAI
E = Programmed Text
F = Conventional
Workbook
(Traditional)

SPACED

A	A^2	B	B^2	C	C^2
75	5625	59	3481	45	2025
84	7056	80	6400	61	3721
88	7744	82	6724	60	3600
86	7396	80	6400	57	3249
84	7056	82	6724	75	5625
82	6724	77	5929	73	5329

MASSED

D	D^2	E	E^2	F	F^2
50	2500	50	2500	42	1764
68	4624	70	4900	40	1600
76	5776	72	5184	37	1369
72	5184	72	5184	48	2304
73	5329	68	4624	60	3600
68	4624	58	3364	54	2916

Σx = 499 460 371 407 390 281

$\bar{x}$ = 83.2 76.7 61.8 67.8 65 46.8

Σx^2 = 41601 35658 23549 28037 25756 13553

x_T = 499+460+371+407+390+281/36 = 66.9

$^{NT}\Sigma x^2$ = 41601+35658+23549+28037+25756+13553 = 168154

SS_T = 168154 - 36 (66.9) = 168154 - 161121.96 = 7032.04

SS_{BG} = 6 (83.2) + 6(76.7) + 6 (61.8) + 6(67.8)+ 6 (65) + (46.8) - 161121.96

= 41533.44 + 35297.34 + 22915.44 + 27581.04 + 25350 + 13141.44 -161121.96

= 165818.7 - 161121.96

= 4696.74

SS_{WG} = 7032.04 - 4696.74 = 2335.3

	SPACED		MASSED		
CAI	83.2	6	67.8	6	= 75.5
Prog.	76.7	6	65	6	= 70.85
Trad.	61.8	6	46.8	6	= 54.3
	=73.9		59.87		

SS_R = 12(75.5)+ 12 (70.85)+12(54.3) - 161121.96

= 68403 + 50236.67 + 35381.88 - 161121.96

= 2899.59

SS_C = 18 (73.9)+ 18 (59.87) - 161121.96

= 98301.78 + 64519.5 - 161121.96

= 1699.32

SS_{RXC} = 4696.74 - 2899.59 - 1699.32

= 97.83

MS_R = 2899.59/2 = 1449.79

MS_C = 1699.32/1 = 1699.32

MS_{RXC} = 97.83/2 = 48.92

MS_{WG} = 2335.3/30 = 77.84

F_R = 1449.79/77.84 = 18.63

F_C = 1699.32/77.84 = 21.83

F_{RXC} = 48.92/77.84 = .63

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ANOVA SUMMARY TABLE

Source of Variance	df	ss	ms	f
Method	2	2899.59	1449.79	18.63*
Condition	1	1699.32	1699.32	21.83*
Mxc	2	97.83	48.92	.63
WG	30	2335.3	77.84	
Total	35			

*Significant, $p < .01$

The F ratio derived for both the teaching method (CAI, programmed text and classroom) and condition (masses vs. spaced instruction) were found to be significant at the $p < .01$ level. From this the project staff was able to conclude that there were indeed substantial differences in terms of the instructional effectiveness of the teaching methods studied, and that the condition under which the instruction was presented (spaced vs. massed) exerted a significant effect. However, meaningful interpretation of the data required a comparison of the pairs of means. This was accomplished via use of the Tukey Method of Multiple Comparisons.

TUKEY METHOD OF MULTIPLE COMPARISONS

A	B	C	D	E	F
83.2	76.7	61.8	67.8	65	46.8

$Ms_{wg} = 77.84$; $df = 30$ $k = 6$

$$\sqrt{\frac{77.84}{6}} = 3.6$$

A & B $q = \frac{83.2-76.7}{3.6} = \frac{6.5}{3.6} = 1.81$

A & C $q = \frac{83.2-61.8}{3.6} = \frac{21.4}{3.6} = 5.94$ *

A & D $q = \frac{83.2-67.8}{3.6} = \frac{15.4}{3.6} = 4.3$

A & E $q = \frac{83.2-65}{3.6} = \frac{18.2}{3.6} = 5.1$ **

A & F $q = \frac{83.2-46.8}{3.6} = \frac{36.4}{3.6} = 10.1$ *

B & C $q = \frac{76.7-61.8}{3.6} = \frac{14.9}{3.6} = 4.14$

B & D $q = \frac{76.7-67.8}{3.6} = \frac{8.9}{3.6} = 2.47$

B & E $q = \frac{76.7-65}{3.6} = \frac{11.7}{3.6} = 3.25$

B & F $q = \frac{77.7-46.8}{3.6} = \frac{30.9}{3.6} = 8.58$ *

C & D $q = \frac{67.8-61.8}{3.6} = \frac{6}{3.6} = 1.66$

C & E $q = \frac{65-61.8}{3.6} = \frac{3.2}{3.6} = .88$

C & F $q = \frac{61.8-65}{3.6} = \frac{2.8}{3.6} = .78$

D & F $q = \frac{67.8-46.8}{3.6} = \frac{21}{3.6} = 5.83$ *

E & F $q = \frac{65-46.8}{3.6} = \frac{18.2}{3.6} = 5.1$ **

*Significant, $p < .01$

**Significant, $p < .05$

Significant differences were found to exist in these comparisons:

(1) A (Spaced computer assisted instruction) versus
C (Spaced Conventional workbook instruction): $q=5.94$, $p < .01$

(2) A (Spaced computer assisted instruction) versus
E (Massed Programmed text): $q=5.1$, $p < .05$

(3) A (Spaced computer assisted instruction) versus
F (Massed conventional workbook instruction): $q=10.0$, $p < .01$

(4) B (Spaced Programmed text) versus
F (Massed conventional workbook instruction): $q=8.58$, $p < .01$

(5) D (Massed computer assisted instruction) versus
F (Massed conventional workbook instruction): $q=5.83$, $p < .01$

(6) E (Massed Programmed text) versus
F (Massed conventional workbook instruction): $q=5.1$, $p < .05$

Analysis of the data suggets that, in a special configuration, computer assisted instruction is clearly more effective than the traditional workbook method in developing reading comprehension skills, the difference here being statistically significant at the $p < .01$ level. Further, visual inspection of the text data served to suggest also that a similar superiority of spaced computer assisted instruction prevailed when contrasted with spaced programmed instruction. However, the text results were not statistically significant. The various other multiple comparisons which were made, while interesting, mainly served to bear out fact generally recognized by educators: that spaced presentation of instruction results in more efficient learning than does massed practice sessions.

Overall, it can be said that the results of this study served to demonstrate that the low-cost microcomputer does indeed have a place in today's basic education classrooms, particular with respect to teaching functional literacy skills where the need for much individualized tutorial interaction with the student is essential.

PROJECT SUMMARY

In summary, results obtained under the adult education special project established clearly the superiority of the computer assisted instruction approach for developing reading comprehension skills on the part of the mentally handicapped adult student. The approach proved to be motivationally superior to the other instructional methods evaluated during the study (programmed texts, conventional classroom (workbook) instruction). The special, mentally-handicapped population participating in the study many times has considerable difficulty achieving in traditional text-oriented, passive learning situations, such as classroom instruction. The project staff found that there was a compelling novelty effect associated with the computer assisted instruction approach which the mentally-handicapped participants found particulary motivating, which did not "wear off" over time as the students came to use microcomputers more and more.

Clearly, the presentation of reading comprehension skills instruction through the use of microcomputers offers a number of advantages to illiterate mentally-handicapped adults which ultimately could help compensate for many of the learning problems discussed earlier in this report. The curriculum is individualized in the computer assisted instruction approach, so that it adjusts learner progress in reading comprehension subskills by teaching to points of weakness and providing time for more opportunities for teacher-student interaction and feedback than could be obtained in a traditional classroom setting. The method's "teaching for mastery" approach insures optimal opportunity for success, thus helping build student confidence and feelings of self-worth. Of particular significance is the fact that the modularized organization of the curriculum allows for flexible adaptation to a wide variety of learning needs and situations.

As a result of this study, we know unequivocally that microcomputer technology has the unparalleled potential for providing extensive, low cost, effective instruction not only in the area of reading comprehension skills, but

in other basic skills areas in which the institutionalized mentally-handicapped adult is typically deficient such as structural analysis, vocabulary development, interpretive comprehension, evaluative comprehension and importantly, the "survival skills" associated with the activities of daily living.

Though not addressed as an element in the special project for which this final report was prepared, it is nevertheless considered worthwhile to mention a recent development of which the project staff became aware during the course of the project. This concerns the commerical availability of "authoring" systems, which permit non-computer programmers to generate effective microcomputer-based courseware, lends even more to the potential that microcomputer technology holds for helping improve the provision of adult basic education services to institutionalized mentally-handicapped individuals.

Authoring systems are software programs that permit a teacher to create subject matter-oriented computer assisted instruction software programs - even though they have not learned how to program a microcomputer. The authoring systems now available are true authoring systems, in that they guide the software writer in the use of well-defined prototypes and formats for organizing educational material. To use the program, the author simply selects the desired format and enters the material to be learned by the student. These are efficient tools in that they allow virtually anyone to create computer assisted instruction software programs quickly and easily. These programs can provide graphics, choice of tutorial or evaluation modes (or both), branching, and student record keeping by session, lesson and question. Of particular advantage is the fact that there is no need to learn to use a programming language, such as BASIC or PASCAL. Teachers simply organize the material they want their students to learn, sit down and enter it directly into the microcomputer. With such authoring programs, teachers can immediately begin using the microcomputer to create special testing and teaching programs. Of course, authoring system will not do all of the work. The teacher will have to plan the lesson, unit, or whatever. But, it is the same type of planning that any good ABE teacher is doing now.